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Effect of agricultural policy on regional income inequality among farm households

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Abstract

Policymakers are under constant pressure to alleviate financial stress, mainly associated with farm business income, on farm households through government farm program payments. The 1996 FAIR Act signaled the end of these payments and Congress decided that agricultural policy should be more market oriented. Using the Gini coefficient concept and a large farm-level dataset, this study investigates the impact of government payments on income inequality among farm households in nine farming resource regions of the U.S. Results indicate that distribution of income among farm households in the Fruitful Rim region was above the level of dispersion for all U.S. farm households; however, income inequality in the Heartland region was below the level of dispersion for all U.S. farm households. Finally, income from government farm programs helped reduce total income inequality in the Heartland and Northern Great Plains regions, while income from off-farm wages and/or salaries played an important role in reducing total income inequality in Basin and Range and Fruitful Rim regions of the U.S. farm sector.

JEL classification: D31; Q12; Q18

Keywords: Income inequality; Off-farm income; Government farm program payments; Adjusted Gini coefficient; Farm resource regions

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Nearly seven decades ago, farm subsidies were promoted by concerns for the chronically low and highly variable incomes of U.S. farm households. A key stimulus for legislative action was disparity between incomes of farm and nonfarm households (Gardner, 1992; Houthakker, 1967). In the 1990s, a major farm bill was passed, the 1996 Federal Agricultural Improvement and Reform (FAIR) Act, which greatly changed U.S. farm policies for its term and subsequent farm bills. The FAIR Act allowed producers greater flexibility in cropping decisions, but also a fixed-but-decreasing production flexibility contract (transition) payment over the next 7 years (Hoppe, 2001). The Act[3] also provided nonrecourse marketing assistance loans with marketing loan repayment (MLA) and loan deficiency payments (LDPs) for selected crops.

In 2002, the Farm Security and Rural Investment (FSRI) Act was signed into law and largely extended the policies of the FAIR Act. While the marketing loan program and direct payments continued, a new "countercyclical payment" was introduced. According to critics, the new farm bill suffered the same shortfall as the previous one: large farms continued to receive a disproportionate share of payments. Martin (2002) adds that government payments, particularly since FAIR, have allowed large farms to become even larger when payments were used for land purchase. This and the argument that FSRI shifted support further toward landowners (via higher land values and lease rates) and away from farmers with no landholdings are apt to raise concerns on the impact of government payments on the distribution of farm household income.

The U.S. has witnessed increased economic growth over the last decade, with increased stock prices, consumer spending, and trade, yielding low unemployment and inflation as well as growing income inequality. Mishra, El-Osta, Morehart, Johnson, and Hopkins (2002) find greater income inequality in farm compared to nonfarm households, as well as regional differences: income inequality is highest for farm households located in the South and Northeast regions and lowest in the North Central region.

A system of economically viable, midsized, owner-operated family farms contributes more to communities than systems characterized by inequality, larger numbers of farm laborers with below average incomes, and little ownership or control of productive assets (Hassebrook, 1999). Farm income inequality negatively impacts: (1) economic well-being, including farm family health; (2) farm technology adoption; (3) agricultural productivity; and (4) agricultural sector growth. It is important to understand the role government farm program payments have played in income inequality among farm households. Regional differences are of interest.

The objectives of this paper are to determine: (1) the dimensions of income inequality among farm operator households, (2) the sources of income inequality, particularly the role of government payments, (3) differences in farm household income inequality by region (Fig. 1), and (4) the contributions of sources of household income to inequality. We use a national farm-level database with a larger, more representative sample than previous studies on this subject.

1. Sources and trends in farm household income

Total farm household income is defined as income from both the farming operation and off-farm sources. Table 1 shows the composition of farm household income. For majority of U.S.

[3] Under FAIR, a farm was eligible for production flexibility contract payments if it had at least one crop acreage base in a production adjustment program for any of the crop years 1991 through 1995.

Table 1
Average farm, off-farm, and total income of farm households, U.S. and farm resource regions, 1996–2001.

	1996	1997	1998	1999	2000	2001
Dollars						
United States (48 States)						
Farm income	7,904	6,205	7,104	6,179	2,872	5,301
Off-farm income	42,455	46,358	52,629	57,988	59,351	58,682
Total household income	50,359	52,564	59,733	64,167	62,223	63,983
Farm resource regions						
Heartland						
Farm income	14,519	9,147	11,688	10,555	7,024	10,371
Off-farm income	37,673	46,040	47,781	51,971	51,476	47,684
Total household income	52,192	55,187	59,469	62,526	58,500	58,055
Northern Crescent						
Farm income	7,171	3,326	5,605	5,200	2,026	1,806
Off-farm income	36,001	46,053	50,043	50,638	61,086	53,912
Total household income	43,172	49,379	55,647	55,838	63,113	55,717
Northern Great Plains						
Farm income	24,631	9,349	13,100	14,844	6,190	16,607
Off-farm income	23,698	30,345	29,675	43,496	51,615	65,317
Total household income	48,329	39,694	42,775	58,340	57,805	81,925
Prairie Gateway						
Farm income	5,127	4,317	6,398	5,606	2,580	−1,373
Off-farm income	48,993	50,174	61,522	61,396	61,552	53,965
Total household income	54,120	54,491	67,920	67,002	64,132	52,592
Eastern Uplands						
Farm income	−1,153	783	−59	549	−2,022	−131
Off-farm income	42,189	42,688	47,920	58,530	57,920	58,691
Total household income	41,036	43,471	47,861	59,079	55,898	58,559
Southern Seaboard						
Farm income	−268.2	4,899	6,339	293	−654.5	891
Off-farm income	59,230	42,371	56,926	59,034	59,171	64,261
Total household income	58,962	47,271	63,266	59,327	58,517	65,152
Fruitful Rim						
Farm income	16,466	15,846	9,621	11,702	7,547	19,027
Off-farm income	42,275	57,291	62,419	78,916	77,666	75,572
Total household income	58,740	73,137	72,040	90,618	85,213	94,599
Basin and Range						
Farm income	811	3,286	5,012	4,767	1,295	3,712
Off-farm income	59,468	47,994	67,150	54,278	67,928	77,402
Total household income	60,278	51,280	72,162	59,045	69,222	81,114
Mississippi Portal						
Farm income	9,107	6,684	6,549	4,675	1,335	2,471
Off-farm income	31,244	48,221	44,722	55,081	45,243	55,539
Total household income	40,351	54,904	51,271	59,756	46,578	58,010

Source: Agricultural Resource Management Survey, 1996–2001. http://www.ers.usda.gov/data/arms/app/Farm.aspx.

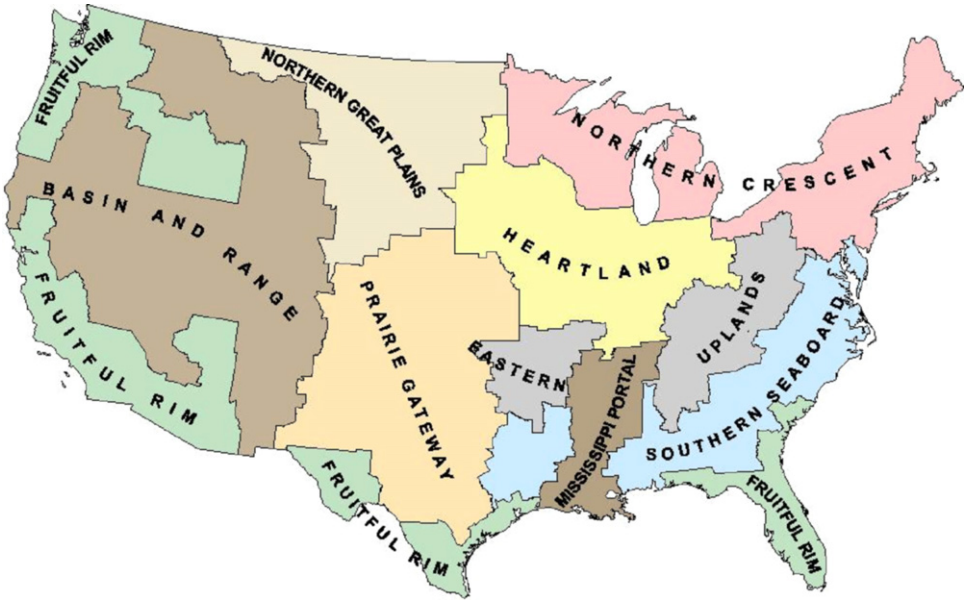

Fig. 1. Farm resource regions of the United States.

farm households, the contribution of off-farm income is high. Furthermore, the contribution of government farm program payments to total household income varies by region (Fig. 2). For example, average farm households in the Northern Great Plains and Heartland regions receive more government payments than the average U.S. farm household. These regions grow the majority of the commodities that are covered by government farm program payments. In this study,

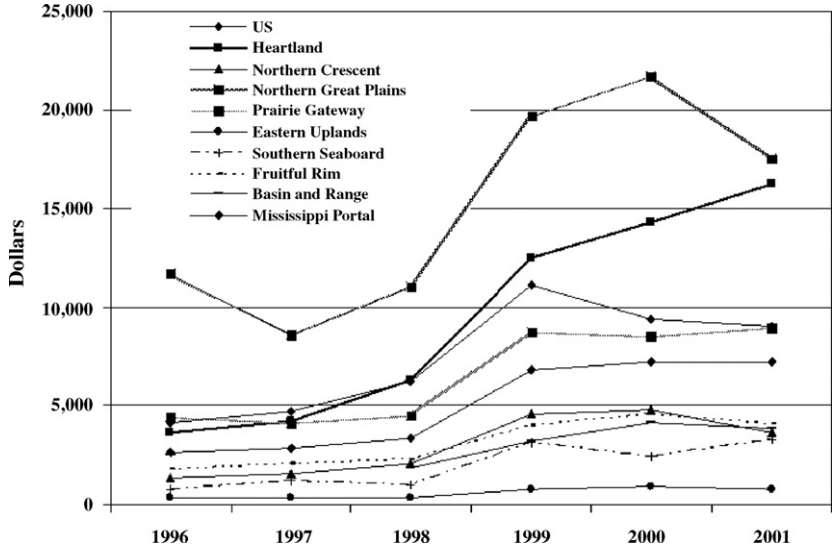

Fig. 2. Average government payments of farm households, by region, 1996–2001.

Table 2
Average income and inequality of income among farm operator households by decile groups, 1996–2001.

	1996	1997	1998	1999	2000	2001
Income ($)						
Decile groups						
First (lowest)	−15,674	−16,610	−14,752	−10,955	−14,159	−13,896
Second	9,215	9,418	11,473	13,856	12,844	13,377
Third	15,949	17,817	20,583	22,761	22,046	24,046
Fourth	21,801	25,938	28,942	31,937	31,039	31,551
Fifth	26,938	33,328	37,533	41,104	39,776	40,464
Sixth	33,954	41,787	47,410	51,123	49,580	49,425
Seventh	44,754	52,989	58,191	62,014	60,142	60,866
Eighth	60,523	66,499	72,644	76,731	74,294	76,988
Ninth	86,371	88,815	103,114	103,534	102,133	102,066
Tenth (highest)	223,955	211,285	229,415	247,572	217,062	234,743
Income (%)						
Share of						
Bottom 60%	18.2	21.0	22.1	23.4	23.8	23.3
Top 1%	11.5	11.3	9.1	10.5	8.6	10.6
Decile shares						
First (lowest)	−3.0	−3.1	−2.5	−1.7	−2.4	−2.2
Second	1.8	1.8	1.9	2.2	2.2	2.2
Third	3.1	3.3	3.5	3.6	3.7	4.1
Fourth	4.3	5.0	4.8	5.0	5.2	4.8
Fifth	5.2 6.7	6.3	6.3	6.4	6.7	6.5
Sixth	8.7	7.8	8.0	8.0	8.3	8.0
Seventh	12.0	10.0	9.7	9.7	10.1	9.8
Eighth	17.0	12.5	12.3	12.0	12.5	12.4
Ninth	44.1	16.7	17.3	16.1	17.2	16.5
Tenth (highest)		39.8	38.6	38.8	36.5	37.9
Adjusted Gini Coefficient	0.603	0.565	0.549	0.535	0.526	0.534
Mean (2001 dollars)	50,880	53,172	59,491	64,051	59,524	61,953
Median (2001 dollars)	29,552	36,694	42,483	45,649	44,477	45,100

The reported estimates have *CV* values of less than 75. For an estimate inside a parenthesis, the coefficient of variation is 75 or above.

total household income is reconfigured into three components: 'government payments,' 'off-farm wages and/or salaries,' and 'income from farming and all other sources,' including farm and all other remaining components of off-farm income such as interest and dividends, social security, etc.

Analysis of income inequality among farm households over the FAIR Act starts by ranking farm households in the 1996–2001 Agricultural Resource Management Surveys (ARMS) by income and dividing the households into 10 decile groups. The first decile includes the 10% of households earning the least, the second decile the next 10%, and so on. Average farm household incomes along with medians and income shares are then estimated for each group. Table 2 shows the average income of farm households (2001 dollars) for the selected samples of trimmed ARMS data by decile for 1996–2001. A sizeable income gap exists across years among incomes of farm households based on the decile group they are located in. Consider households in the 5th and 10th deciles. This comparison reveals the top 10% of farm households, on average, have >5 times more

income than their counterparts at the middle of the distribution. Despite this unequal distribution, Table 2 suggests most farm households experienced income growth during 1996–2001, as average 2001 income relative to 1996 increased for all decile groups.

The distribution of income share among the bottom 60% and top 1% of farms provides a picture of the extent of income disparity. In 1996, while the bottom 60% of farm households earned 18% of the $99 billion in total farm household income, the top 1% earned more than 11% (Table 2). In 2001, while the bottom 60% earned 23% of the $129 billion in total farm household income, the top 1% earned >10%. Despite the disproportionate share earned by the top 1%, its share dropped 8% while the share of households in the bottom 60% increased 28%, indicating improvement in the income distribution between the periods. Comparing income disparities between farm and all U.S. households shows that they are higher for farm households: in 2001, while the bottom 60% of all U.S. households earned 27% of total household income, the bottom 60% of farm households earned 23% of total farm household income. Percentages of income received by the top 20% of the respective groups of households were 50% and 54%.

2. Literature review

Though income inequality has been addressed in the economic literature (Poterba, 2007; Taylor, 1992), little work has addressed the issue among farm households. Studies have analyzed income disparities in the European agricultural sector (Knigma and Oskam, 1987; Von Witzke, 1979), but limited work has examined the subject in the U.S. agricultural sector. A study by Gardner (1969), which investigated income inequality of U.S. farm families, found significant differences among states. In examining farm income distributions, many studies have used the Gini coefficient. Ahearn, Johnson, and Strickland (1985) used this technique with 1984 Farm Costs and Returns Survey data to assess dispersion of the farm income distribution. They found higher inequality in the distribution of total farm household income in 1984 than in 1966, and any increases in government payments and household farm income would decrease income inequality. Ahearn et al. (1985), however, did not analyze differences by region.[4]

Findeis and Reddy (1987) and Reddy, Findeis, and Hallberg (1988) used 1985 Current Population Survey data and the Gini coefficient to examine farm income inequality. Findeis and Reddy (1987) conclude that whether off-farm income reduces income inequality depends upon region. Gould and Saupe (1990) applied the approach to Southwestern Wisconsin data, concluding that nonfarm employment income increased income inequality among farms. A major flaw of the previous studies was negative incomes were set to zero, potentially underestimating inequality.

Boisvert and Ranney (1990) and El-Osta, Bernat, and Ahearn (1995) used the "adjusted" Gini coefficient, which accounts for the presence of negative incomes, to examine farm income inequality. Boisvert and Ranney (1990) conclude that farm income is more unequally distributed than either government payments or nonfarm income among New York dairy farm families. Using the 1991 Farm Costs and Returns Survey, El-Osta et al. (1995) conclude that farm households without off-farm income have higher income equality than those with off-farm income. They also find differences in distributions of income among farm households by region. These studies point to the importance of off-farm employment in reducing income inequality among farm

[4] It is reasonable to expect that regional differences in effects of off-farm employment income may exist due to regional variations in the proximity and types of jobs available to farm families. Additionally, farming may differ from location to location.

families, hence the importance of rural development policies aimed at promoting better off-farm work opportunities. Using 1997 ARMS data and the adjusted Gini coefficient, Mishra et al. (2002) found that the distribution of farm income was more unequal than that of wealth and farm location played a role in income inequality. Mishra et al. (2002) had several weaknesses. They used only 1 year of data to examine income inequality, aggregated the data into only four regions, and did not investigate sources of income inequality.

This paper extends previous research on farm income inequality by using a method that improves the accuracy of Gini coefficient estimates. Data are grouped into nine farm resource regions that merge information about land characteristics and commodities produced, cut across state boundaries, and are more homogenous with regard to resource and production activities. Unlike Boisvert and Ranney, we examine regional income inequality and consider money and non-money income, as suggested by Larson and Carlin (1974). Unlike Ahearn et al., we exclude the 3% of farms organized as non-family corporations, cooperatives, or managed by operators not sharing in the net income of the business. In contrast to the Current Population Survey used by Findeis and Reddy (1987) and Reddy et al. (1988), the ARMS data includes farm households residing both on and off the farm. About 20% of all U.S. farm households reside off their farms (Mishra et al., 2002). Ahearn et al. (1985) report that these farm households earn more money from government programs and off-farm work than those that reside on the farm. Finally, we include farm-level data for 6 years (1996–2001). Since most farm households have steady sources of off-farm income from wages and salaried jobs (Mishra et al., 2002), this study includes income from wages and salaried jobs as off-farm income.

3. Measurement of inequality

In cases where the income of each household is non-negative, the standard Gini coefficient (referred to as just the Gini coefficient) with range [0,1] provides a relative measure of inequality.[5] If farm household income, for example, is equally distributed, the Gini coefficient would be 0. With greater income inequality, the Gini coefficient approaches a value of 1. Where income is comprised of k components, the Gini coefficient for the kth income component, Y_k, is defined based on Pyatt, Chen, and Fei (1980) and extended by Lerman and Yitzhaki (1985) as:

$$G(Y_k) = 2\,\mathrm{cov}\frac{[Y_k,\, F(Y_k)]}{\bar{Y}_k}, \tag{1}$$

where $F(Y_k)$ is the cumulative distribution of Y_k (ranked in nondecreasing order), $\bar{Y}_k$ is the mean of Y_k, and cov is a covariance indicator.

Let n denote the sample size. The estimator of $F(Y_k)$ in a random sample is the rank of Y_k divided by n. In a weighted sample where w_i is the survey weight that corresponds to the ith household, $\sum_{i=1}^{n} w_i = 1,\ w_0 = 0$, and the estimator of $F(Y_k)$ is a mid-interval of $F(Y_k)$ or

$$\hat{F}_i(Y_k) = \sum_{j=0}^{i-1} w_j + \frac{w_i}{2} \tag{2}$$

[5] This measure of inequality dates back to 1912 when it was formulated by the Italian statistician Corrado Gini.

Once the value of $F_i(Y_k)$ is estimated based on (2), this allows for the direct estimation of the weighted covariance between Y_k and $\hat{F}(Y_k)$ as follows:

$$\xi_k = \text{cov}[Y_k, \hat{F}(Y_k)] = \sum_{i=1}^{n} w_i(Y_{i,k} - \bar{Y}_k)[\hat{F}_i(Y_k) - \bar{F}(Y_k)] \tag{3}$$

The Gini coefficient for Y_k in the presence of weights, where $\bar{Y}_k$ is the weighted mean, is:

$$G(y_k) = \frac{2\xi_k}{\bar{Y}_k}, \quad 0 \le G(Y_k) \le 1 \tag{4}$$

Many studies have formulated Gini decomposition schemes and relative measures that capture the impact of various components of income on inequality (Lerman & Yitzhaki, 1985; Pyatt et al., 1980). To demonstrate with weighted data, let R_k denote the ratio of the correlation between the income component Y_k and the rank of total income Y and the correlation between Y_k and its own rank, and let ϕ_k denote the share of Y_k relative to Y as (5) and (6):

$$R_k = \text{cov}\frac{\left[Y_k, \hat{F}(Y)\right]}{\xi_k} \quad -1 \le R_k \le 1 \tag{5}$$

$$\phi_k = \frac{\bar{Y}_k}{\bar{Y}}. \tag{6}$$

Inspection of (5) suggests that $R_k = 1$ only if $\hat{F}(Y_k) = \hat{F}(Y)$, implying that farm families have the same ranking with respect to the kth income component as they have with respect to total income (see Pyatt et al., 1980). Eqs. (5) and (6) allow for derivation of the Gini index of total income Y and of various relative measures important to studies of income distributions:

$$G(Y) = \sum_{k=1}^{K} G(Y_k)R_k\phi_k \quad 0 \le G(Y) \le 1. \tag{7}$$

Payat et al. and Lerman and Yitzhaki (1985) developed a measure that partitions the overall inequality of a particular distribution into contributing components. This measure, in the case of income, accounts for the 'proportional contribution to inequality' by the kth income source:

$$P_k = \frac{G(Y_k R_k \phi_k)}{G(Y)}. \tag{8}$$

Another useful measure is η_k, the Gini elasticity of income for source k. It is the ratio of the proportional contribution to inequality P_k to the kth source's share of total income:

$$\eta_k = \frac{P_k}{\phi_k} = \frac{G(Y_k)R_k}{G(Y)} \tag{9}$$

This measure allows for quick identification of whether the component in question has a neutral impact ($\eta_k = 1$), an increasing impact ($\eta_k > 1$), or a decreasing impact ($\eta_k < 1$) on inequality.

Lerman and Yitzhaki (1985), p. 153, derived a measure that captures the effects on inequality associated with marginal changes in income components. This 'relative marginal effect,' M_k, is obtained as in (10) and (11):

$$\frac{\partial G(Y)}{\partial \varepsilon_k} = \phi_k[R_k G(Y_k) - G(Y)]. \tag{10}$$

$$M_k = \frac{[\partial G(Y)/\partial \varepsilon_k)]}{G(Y)} = P_k - \phi_k = \frac{G(Y_k)R_k\phi_k}{G(Y)} - \phi_k = \phi_k(\eta_k - 1). \tag{11}$$

As Lerman and Yitzhaki discuss, the sum of the k marginal effects equals zero, implying that if all sources are multiplied by $(1-\varepsilon)$, the overall Gini coefficient will be left unchanged.[6] Eq. (11) further implies that a percentage increase in income from a source with Gini elasticity $\eta_k < 1$ ($\eta_k > 1$) reduces (increases) inequality (Estudillo, 1997; Wodon and Yitzhaki, 2002). The lower the Gini elasticity of the kth component, the larger is the equalizing impact of this income source.

The advantage of using the Pyatt et al. (1980) and Lerman and Yitzhaki (1985, 1989) methods to compute the Gini coefficient is that the result can be decomposed by income sources, and the marginal effects derived analytically.[7] However, with substantial incidence of negative incomes, $G(Y)$ as defined in (4) and (7) may become overstated, perhaps causing values $G(Y) > 1$. This makes comparisons of inequality across populations or time periods problematic.[8] However, the procedure outlined in (4)–(11) remains applicable, as Pyatt et al. suggested and noted by Findeis and Reddy (1987), as long as the average value of the income source is positive for the entire sample.

To correct for problems associated with negative incomes, Chen, Tsaur, and Rhai (1982) developed the "adjusted" Gini coefficient, $G^*(Y)$, where $G(Y)$ is normalized so that the upper bound on the Gini coefficient is unity. $G^*(Y)$, further developed by Berrebi and Silber (1985) and applied by Boisvert and Ranney (1990), El-Osta et al. (1995), and Mishra et al. (2002) is:

$$G^*(Y) = \frac{(2/n)\sum_{j=1}^{n} jy_j - (n + 1/n)}{\left[1 + (2/n)\sum_{j=1}^{m} jy_j\right] + (1/n)\sum_{j=1}^{m} y_j \left[\left(\sum_{j=1}^{m} y_j/y_{m+1}\right) - (1+2m)\right]},$$

$$\text{where } y_j = \frac{Y_j}{n\bar{Y}} \quad \text{and} \quad \bar{Y} = \frac{\sum_{j=1}^{n} Y_j}{n} > 0 \tag{12}$$

This is presented without showing the presence of weights; n is the number of households; y_j the weighted income share of the jth household; Y_j the household's total income where $Y_1 \leq \cdots \leq Y_n$ with some $Y_j < 0$; and m the size of the subset of households whose combined income is zero with $Y_1 \leq \cdots \leq Y_m$. For computational purposes, m is determined where the sum of incomes over the first m households is negative and the first $m+1$ household is positive. With no negative income observations and when the observations originate from a random and non-weighted sample, $G(Y) = G^*(Y)$. With negative observations that are weighted, $G^*(Y) \leq G(Y)$.[9]

The advantage of the "adjusted" Gini in the presence of negative incomes is that it allows for the same geometric interpretation as the "standard" Gini. However, the "adjusted" Gini measure has

[6] This is also known as Dalton's 'principle of proportionate change' which along with other principles have become accepted as "basic" properties of inequality measures, serving to reduce the number of allowable measures. For a thorough discussion on this and other axioms of inequality measures, see Foster (1983) and Hubbard, Allanson, and Renwick (1998).

[7] No consensus has been reached in the literature on the proper way to decompose income inequality indices. Shorrocks (1983) has discussed this issue succinctly and has evaluated the performance of different decomposition rules including those relevant to the Gini coefficient.

[8] To circumvent the problem with negative observations, some researchers have substituted these observations with zeros (Ahearn et al., 1985). This method understates the extent of inequality (Kinsey, 1985).

[9] For a more detailed discussion of circumstances under which $G^*(Y)$ may be equal to or less than $G(Y)$, see El-Osta et al. (1995). In the presence of negative sample and weighted data, there may exist situations, depending on the value of the weighted m in Eq. (12) (or as computationally required, $m+1$), the adjusted Gini may slightly exceed the standard Gini. This should be considered as an aberration due to the presence of weights.

two major limitations: (1) it does not allow for an accurate decomposition of income inequality by source, and (2) any M_k derived using this concept must be derived using simulation techniques. As Boisvert and Ranney (1990) note, the M_k derived using this technique is analytically inconsistent because of the need to use finite changes in components of total income in the simulation. A limitation is that the sum of the k marginal effects is unequal to zero when all households' incomes from each source are multiplied by k. In comparison, marginal effects derived from using the "standard" Gini, while analytically consistent, are biased. Though marginal effects based on the "standard" Gini are always higher than those derived under the "adjusted" Gini, retain the same sign (Boisvert & Ranney, 1990). Hence, qualitative policy implications are the same.

Recognizing the advantages and the disadvantages of the "standard" and "adjusted" Gini coefficients, we adopt the "standard" Gini to measure income inequality of each income source and to measure the importance of each income source to total income inequality. Furthermore, it is used to provide qualitative policy implications to changes in the income sources in terms of effects on income inequality.[10] Due the presence of negative incomes, the "adjusted" Gini is used for comparing income inequality among farm operator households across the 1996–2001 period.

4. Data

1996–2001 Agricultural Resource Management Survey (ARMS) are used to measure income inequality among U.S. farm households, with detailed analysis performed for regional household subgroups for only the 1996 and 2001 survey years. The ARMS, which has a complex stratified, multiframe design, is a national survey conducted annually by the USDA Economic Research Service and National Agricultural Statistics Service. Since the income variable contains some extremely high or low observations, 0.25% of the weighted observations at both the top and the bottom ends of the distributions were trimmed.

5. Results

Across all years, estimated income means exceed their corresponding medians, indicating the presence of inequality (Table 2). In each case, the mean is greater than the median in the income distribution, indicating >50% of the farm households earn incomes below the average. Table 2 shows the extent of income disparity via the relative share of the total income accruing to each decile group.[11] During 1996–2001, while the relative share of total income improved with varying strength for households in the first eight deciles, the increase in the relative share had mixed results for the ninth and decreased rather steadily for households in the top decile.

Next we examine the contribution of the income components to total household income inequality. At the national level, Table 3 indicates the standard Gini coefficient of total income for the U.S. declined steadily from 0.607 in 1996 to 0.536 in 2001. Of the three income components, 'Income from farming and all other sources' was the most unequally distributed, with Gini coefficients

[10] Only policy implications that are qualitative in nature will be addressed in the paper since in the presence of negative incomes, other types of implications will be meaningless due to the overstatement of the Gini coefficient.

[11] This paper cannot make reference to social mobility. The ARMS data do not provide information on which farm household in the first income decile group, for example, might have moved up the social ladder to a higher group.

Table 3
Gini decomposition of farm household income, 1996–2001.

	1996	1997	1998	1999	2000	2001
Share in total income (ϕ)						
Total income	1.000	1.000	1.000	1.000	1.000	1.000
Off-farm wages and/or salaries	0.517	0.551	0.560	0.539	0.567	0.531
Government payments	0.063	0.050	0.068	0.098	0.110	0.102
Income from farming and all other sources	0.419	0.399	0.372	0.363	0.323	0.367
Gini coefficient ($G(Y_k)$)						
Total income	0.607	0.570	0.553	0.537	0.529	0.536
Off-farm wages and/or salaries	0.642	0.650	0.604	0.642	0.615	0.626
Government payments	0.878	0.856	0.873	0.871	0.867	0.872
Income from farming and all other sources	1.135	1.119	1.122	1.111	1.289	1.204
Gini correlation (R_k)						
Total income	1.000	1.000	1.000	1.000	1.000	1.000
Off-farm wages and/or salaries	0.672	0.660	0.679	0.690	0.672	0.635
Government payments	0.354	0.131	0.193	0.190	0.153	0.158
Income from farming and all other sources	0.765	0.735	0.746	0.700	0.673	0.704
Proportional contribution to inequality (P_k)						
Total income	1.000	1.000	1.000	1.000	1.000	1.000
Off-farm wages and/or salaries	0.368	0.414	0.416	0.445	0.442	0.393
Government payments	0.032	0.010	0.021	0.030	0.028	0.026
Income from farming and all other sources	0.600	0.576	0.563	0.525	0.530	0.581
Gini income elasticity (η_k)						
Total income	1.000	1.000	1.000	1.000	1.000	1.000
Off-farm wages and/or salaries	0.711	0.752	0.742	0.824	0.781	0.741
Government payments	0.511	0.196	0.304	0.308	0.250	0.257
Income from farming and all other sources	1.430	1.443	1.515	1.447	1.639	1.581
Relative marginal effect (M_k)						
Total income	0.000	0.000	0.000	0.000	0.000	0.000
Off-farm wages and/or salaries	−0.150	−0.137	−0.145	−0.095	−0.124	−0.138
Government payments	−0.031	−0.040	−0.047	−0.068	−0.083	−0.076
Income from farming and all other sources	0.180	0.177	0.192	0.162	0.207	0.213

ranging from 1.111 to 1.289.[12] The next source with high inequality was 'Government payments' with Gini values ranging from 0.856 to 0.878. Though 'off-farm wages and/or salaries' exhibits a fair amount of dispersion with Gini coefficients ranging from 0.604 to 0.650, its distribution nevertheless remains the least dispersed of the three components.

Inspection of Eq. (8) reveals that the kth component, in comparison to other income components, contributes the most to total income inequality when the product of the three terms, $G(Y_k)\cdot R_k\cdot\phi_k$, is the largest. Findings in Table 3 affirm this by showing that the residual income component across the 1996–2001 period contributed the most (>50%) to inequality. Next in importance in contribution towards inequality in total income is income from 'off-farm wages and/or salaries', with income from 'Government payments' accounting for the least. Emphasizing the

[12] The Gini coefficient of the income component can exceed unity due to negative observations. However, as long as the average value for this component is non-negative, the procedure to decompose the Gini coefficient into contributing components as used here remains valid (see Payatt et al., 1980).

impact of these three income sources on inequality for 1996 and 2001 reveals that the contribution of residual income declined from 60.0% to 58.1%, respectively; that of off-farm labor income increased from 36.8% to 39.3%; and that of government payments declined from 3.2% to 2.6%.

Table 3 also provides findings with regard to the Gini income elasticities (fifth panel) for the three income components η_k. The Gini elasticity for residual income across the 1996–2001 period are all >1, which, as noted earlier (see discussion of Eq. (11)), indicate that this income source is inequality increasing. The fact that the values of these elasticities are >1 indicates that a change in this income source affects the incomes of higher income farm households more, in percentage terms, than it affects the incomes of lower income households, thereby increasing inequality. In comparison, both incomes from 'Off-farm wages and/or salaries' and 'Government payments' have Gini elasticities with values <1, which suggests these factor components are inequality decreasing. Such interpretation implies that changes in these factors would impact the farm households in the lower end of the income distribution more than they would impact those at the top of the distribution. In terms of trends in η_k over the 1996–2001 period, results in Table 3 indicate a general rise in the unequilizing effect from residual income, a general drop in the equalizing effect from off-farm wages and/or salaries, and a general increase in the equalizing effect from government payments. Similar trends are observed from the results of the relative marginal effects (M_k) of these components, as evident in the lower panel of Table 3.

Results in Table 4 show variation in income inequality based on the regional delineation of the data. Three regions in 1996 (Southern Seaboard, Fruitful Rim, Basin and Range) and two in 2001 (Northern Great Plains, Fruitful Rim) have income dispersion levels exceeding their corresponding levels (i.e., 0.607 in 1996 and 0.536 in 2001) for the whole U.S. If income dispersion for a region is higher than dispersion for the full sample, this suggests a potential means to lowering inequality in the nationwide income distribution.[13] In these five regions in 1996 and 2001 where income dispersion exceeded the corresponding levels for the whole U.S., a question arises: which income components could be utilized to reduce total income inequality? Columns 2 and 6 in Table 4 show the 1996 and 2001 proportional contribution to inequality by income source and region, respectively. For the Southern Seaboard and Fruitful Rim in 2001, because the 'Income from farming and all other sources' component in each of these regions contributes (i.e., $P_k = 0.640$ and 0.627, respectively) measurably a larger share to inequality than it contributes to total income in terms of relative share (i.e., $\phi_k = 0.450$ and 0.393, respectively), marginal increases in this income component act to exacerbate income inequality rather than to reduce it (Table 4). Instead, income from off-farm wages and/or salaries in both of these regions in 1996, while it contributes a sizeable share towards inequality (i.e., $P_k = 0.354$ and 0.299, respectively, Table 4), this level of contribution across 1996 remains lower than what it contributes (i.e., $\phi_k = 0.531$ and 0.504, respectively) to the total household. This suggests a marginal increase in this component will decrease inequality in total household income. Income from government payments in the Southern Seaboard and Fruitful Rim, while accounting respectively for 2% and 10% of the total income in 1996, contributed minimally to inequality in 1996 (0.6% and 7.4%). To the extent that the contribution of government payments to inequality was less than its contribution to total income, a marginal increase in this income source in both of these regions is shown to decrease inequality, although minimally. In 2001, while only a marginal increase in income from government payments allows for a decrease in inequality in the Basin and Range, marginal increases in both this source of

[13] Usage of phrases 'full sample', 'nationwide', 'whole U.S.', or 'entire U.S.' refers to farm-level data from the ARMS that encompass only the 48-continguous states in the U.S.

Table 4
Gini decomposition of farm household income by farm resource regions, 1996 and 2001.

	1996				2001			
	$G(Y_k)$	P_k	η_k	M_k	$G(Y_k)$	P_k	η_k	M_k
Heartland								
Total income	0.541	1.000	1.000	0.000	0.488	1.000	1.000	0.000
Off-farm wages and/or salaries	0.633	0.312	0.695	−0.137	0.579	0.287	0.565	−0.221
Government payments	0.721	0.025	0.344	−0.047	0.707	0.062	0.254	−0.182
Income from farming and all other sources	0.948	0.663	1.385	0.184	1.819	0.651	2.632	0.403
Northern Crescent								
Total income	0.601	1.000	1.000	0.000	0.532	1.000	1.000	0.000
Off-farm wages and/or salaries	0.665	0.390	0.737	−0.139	0.616	0.419	0.741	−0.146
Government payments	0.837	0.003	0.112	−0.026	0.832	0.005	0.077	−0.055
Income from farming and all other sources	1.095	0.607	1.375	0.165	1.207	0.576	1.536	0.201
Northern Great Plains								
Total income	0.605	1.000	1.000	0.000	0.613	1.000	1.000	0.000
Off-farm wages and/or salaries	0.689	0.118	0.479	−0.128	0.776	0.491	1.013	0.007
Government payments	0.618	0.114	0.516	−0.107	0.737	0.049	0.219	−0.176
Income from farming and all other sources	0.977	0.768	1.440	0.235	1.344	0.460	1.584	0.170
Prairie Gateway								
Total income	0.592	1.000	1.000	0.000	0.530	1.000	1.000	0.000
Off-farm wages and/or salaries	0.594	0.345	0.673	−0.168	0.630	0.435	0.769	−0.131
Government payments	0.805	0.025	0.308	−0.056	0.850	0.031	0.207	−0.118
Income from farming and all other sources	1.140	0.630	1.549	0.223	1.568	0.534	1.871	0.249
Eastern Uplands								
Total income	0.557	1.000	1.000	0.000	0.535	1.000	1.000	0.000
Off-farm wages and/or salaries	0.611	0.602	0.885	−0.079	0.590	0.387	0.720	−0.151
Government payments	0.947	0.001	0.146	−0.007	0.944	0.001	0.132	−0.010
Income from farming and all other sources	1.153	0.397	1.277	0.086	0.981	0.611	1.356	0.161
Southern Seaboard								
Total income	0.611	1.000	1.000	0.000	0.478	1.000	1.000	0.000
Off-farm wages and/or salaries	0.623	0.354	0.667	−0.177	0.577	0.349	0.691	−0.157
Government payments	0.942	0.006	0.319	−0.013	0.950	0.018	0.447	−0.022
Income from farming and all other sources	1.122	0.640	1.421	0.190	0.910	0.633	1.392	0.178
Fruitful Rim								
Total income	0.772	1.000	1.000	0.000	0.609	1.000	1.000	0.000
Off-farm wages and/or salaries	0.686	0.299	0.593	−0.205	0.655	0.382	0.723	−0.146
Government payments	0.965	0.074	0.717	−0.029	0.958	0.016	0.432	−0.022
Income from farming and all other sources	1.660	0.627	1.597	0.234	1.095	0.602	1.387	0.168
Basin and Range								
Total income	0.656	1.000	1.000	0.000	0.508	1.000	1.000	0.000
Off-farm wages and/or salaries	0.664	0.609	0.848	−0.109	0.688	0.617	1.023	0.014
Government payments	0.917	0.006	0.147	−0.033	0.913	−0.004	−0.085	−0.046
Income from farming and all other sources	1.468	0.385	1.585	0.142	0.985	0.386	1.089	0.032
Mississippi Portal								
Total income	0.588	1.000	1.000	0.000	0.457	1.000	1.000	0.000
Off-farm wages and/or salaries	0.641	0.372	0.818	−0.083	0.567	0.359	0.761	−0.113
Government payments	0.922	0.065	0.863	−0.010	0.896	0.060	0.467	−0.069
Income from farming and all other sources	0.956	0.563	1.198	0.093	0.981	0.581	1.456	0.182

income and in income from 'off-farm wages and/or salaries' are capable of decreasing inequality in total household income.

Findings in Table 4 indicate that an increase in either off-farm wages or government payments, particularly in the Heartland region, would have lowered income inequality in both 1996 and 2001. The impact of off-farm income in lowering inequality, due to its large share of total income, is greater than the impact from government payments. Any deterioration of these two components would adversely impact overall income inequality, in general and particularly for the Heartland. Consider government payments where its share rose from 7.2% in 1996 to 24.4% in 2001 ('Government payments' does not include the significant disaster payments that were made in the latter years of the FAIR). Any decline in government payments would result in a worsening regional income distribution. This is not surprising since government payments correlate mildly with total income (Mishra et al., 2002), implying that any reduction in the 'government payments' component would adversely impact household incomes in the mid to lower end of the income distribution more so than those in the top.

Similar conclusions with regard to the importance of government payments in lowering farm household income dispersion can be reached for the Northern Great Plains (Table 4). The Northern Great Plains is the only region whose distribution of total farm household income widened during the FAIR. In this region, government payments contributed nearly 5% to the inequality of income in 2001, down from 11% in 1996 (Table 4). Further, the Gini correlation ratio for the government payment component fell from 50.6% in 1996 to 18.2% in 2001, pointing to the increased importance of this component to farm households in the mid to lower end of the income distribution. Unlike the off-farm labor component, a marginal increase in income from government payments in 2001 seems to have had a stronger dampening effect on total household income inequality in comparison to its effect in 1996.

6. Summary and implications

Results of this study show a reduction in farm household income inequality over the period of the FAIR Act, 1996–2001. This decrease was associated with an increasing trend in median household income. Despite the improvement in median incomes and reduction in income inequality, income dispersion remained pervasive. Among the factors that contributed the most towards income inequality was 'income from farming and all other sources.' A marginal increase in this component was found to exacerbate income inequality, while marginal increases in the other components, 'government payments' and 'off-farm wages and/or salaries,' lessened inequality. The impact of income from 'government payments,' due to its small share in total income, was relatively mild, though its impact increased over the period of the FAIR Act.

Differential impacts of the contributing components by location were found. Of nine U.S. production regions, the income distribution among farm households in the Fruitful Rim was more dispersed than that for all nine regions combined during 1996 and 2001. In contrast, income inequality in the Heartland was for both years below that of the entire U.S. Results show that in the Northern Great Plains, the government payments contribution to inequality was the highest among all regions in 1996 and declined in importance to second place after the Heartland in 2001. Further, a marginal increase in off-farm wages and/or salaries decreased total income inequality. In the Heartland, marginal increases in 'government payments' and 'off-farm wages and/or salaries' would lower total income inequality.

If the purpose of farm policy is to raise farmer incomes and standards of living, then policy provisions need to be reconsidered as changes occur in farm households and businesses. The

close association of farm households and their businesses that once allowed the income of the farm and the farm household to be considered as synonymous no longer hold. These results show the importance of recognizing the heterogeneity that exists among farm households by both region and participation in off-farm employment. In some regions, government payments play an important role in decreasing income inequality within farm households. Thus, reductions in government payments may have an adverse impact on the overall distribution of farm household income in some farming regions. Policies may need to be designed to consider work choice decisions and income generating abilities of farm families. Rural economic development efforts to stimulate off-farm employment opportunities through stable employment and higher wages will lead to decreased farm household income inequality in some farming regions.

Generally, increased government payments to farmers leads to decreased income inequality. Previous work has shown the positive correlation between income equality, stability, and overall economic well-being of a region though increased business. Considering this, increased government payments would serve to increase stability and economic well-being of farmers, as well as expand and increase the viability of agricultural businesses that supply inputs and purchase product. Increased agricultural business viability, in turn, would yield greater employment opportunities, some of which could be filled through off-farm employment. Results of this study suggest increased off-farm employment opportunities would further serve to stabilize farm operator household income. Thus, if major objectives of farm policy are to increase economic well-being and stability, our results suggest that increased government farm programs would help in meeting this end.

The whole U.S. results showing government programs as an equalizer of farm household income may be further seen in the regional analysis. We found that the Fruitful Rim had the highest dispersion in farm household income, where crops grown include a number of fruit and vegetables, none of which have historically been supported by extensive government payments. It is of interest that the 2007 Farm Bill has new provisions for government payments for specialty crops, which would include some fruit and vegetable production. Thus, if increased farm payments to these crops occur, then the Fruitful Rim may experience an increase in income equality across farms. Future research analyzing the influence of the 2007 Farm Bill on income inequality will, therefore, also benefit from extensive regional analysis.

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